MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

PPS0034 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Business)

23 OCTOBER 2019
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 pages with **FOUR** questions.

2. Attempt **ALL** four questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the answer booklet provided. All necessary workings **MUST** be shown.

4. **Formulae** are provided at the back of the question paper.

5. **Statistical table** is provided.

QUESTION 1

a) Let X be the discrete random variable with the following probability distribution.

X	-2	1	2	3.5
$P(X=x)$	t	0.34	0.24	t

i) Find the value of constant t. (2 marks)

ii) Find P (X = *an integer*). (2 marks)

iii) Find the expected value and variance for the random variable X. (6 marks)

b) The continuous random variable Y has the following probability density function:

$$f(y)=\begin{cases} k+\frac{1}{4}y & ; \quad -2\le y<0 \\ k-\frac{1}{4}y & ; \quad 0\le y\le 2 \\ 0 & ; \quad \text{otherwise} \end{cases}$$

i) Find the value of constant $\boldsymbol{k}$. (6 marks)

ii) Find the mean and variance for the random variable Y. (9 marks)

(Total 25 marks)

QUESTION 2

a) An appliance store sells 20 refrigerators each week. 88% of all purchasers of a refrigerator **do not** buy an extended warranty. Let X denote the number of the next 20 purchasers who do so. Determine the

i) expected number and standard deviation of purchasers who buy an extended warranty. (4 marks)

ii) probability that between 12 and 18 of purchasers who **do not** buy an extended warranty. (4 marks)

iii) probability that at most 6 purchasers who buy an extended warranty. (2 marks)

b) The number of misprints on a page of the monthly magazine has a Poisson distribution with mean 1.4. Find the probability that the number of errors

i) on page five is not more than 4. (2 marks)

ii) on the first 10 pages is from 8 to 17. (3 marks)

iii) from page 9 to page 22 is exactly 12. (3 marks)

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c) A factory produces grape juice contained in a bottle of 1.5 litres. However, due to random fluctuations in the automatic bottling machine, the actual volume per bottle varies according to a normal distribution. It is observed that 10% of bottles are under 1.35 litres whereas 5% contain more than 1.60 litres. Calculate the mean and standard deviation of the volume distribution. (Leave all your answers in 4 decimal places.) (7 marks)

(Total 25 marks)

QUESTION 3

a) The following measurements are the temperature (in F) for each day in a week.

70 72 68 50 90 80 72

i) List all the possible samples of size six (without replacement) from this population and construct the sampling distribution of the sample mean. Then, find the sampling error for each sample. (Leave your answers in 2 decimal place.) (15 marks)

ii) If a random sample of 6 measurements: 70, 72, 50, 90, 80, 72 was mistakenly recorded as 70, 72, 50, 90, 80, 70, calculate the non-sampling error. (3 marks)

b) The lifetime of a particular type of cookware is normally distributed with a mean of 1735 days and a standard deviation of 118 days. The manufacturer randomly selected 650 cookware of this type and ship them to R Superstore.

i) What is the probability that the average lifetime of these cookware is between 1716 and 1742 days? (5 marks)

ii) What is the probability that the average lifetime of these cookware is more than 1720 days? (2 marks)

(Total 25 marks)

Continued...

QUESTION 4

a) A recent review of hotel bills was conducted over a 12–month period. The review indicated that, on average, errors in hotel bills resulted in overpayment of RM11.84 per night. To determine if such mistakes are being made at a major hotel chain, the CEO might direct a survey. The sample data are:

10.78	8.03	8.82	12.36	10.21	10.88
11.01	9.34	8.49	10.23	11.53	9.55
10.53	8.70	11.68	8.19	10.61	9.99
13.13	7.99	9.29	12.40	11.30	9.76
8.22	12.52	10.56	10.29	9.87	12.40

Assume that the population variance is RM2.07.

Does the hotel have sufficient evidence to conclude that the actual average is different from RM11.84 at the $\alpha = 0.08$ level of significance? (10 marks)

b) The personnel manager for a large airline has claimed that, on average, workers are asked to work no more than 4.5 hours overtime per week. Past studies show the standard deviation in overtime hours per week to be 1.3 hours. Suppose the union negotiators wish to test this claim by sampling payroll records for 250 employees. The payroll records produced a sample mean of 4.85 hours. Can you conclude that the personnel manager's claim is untrue at a 0.3% significance level? (9 marks)

c) A pizza company delivers pizzas throughout its local market area at no charge to the customers. However, customers often tip the driver. The owner is interested in estimating the mean tip income per delivery. To do this, she has selected a simple random sample of 42 deliveries that revealed a mean of RM2.25 and a standard deviation of RM0.28. Construct a 94% confidence interval for the true population mean. (6 marks)

(Total 25 marks)

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Formulae:

1.

	Mean	**Variance**
Discrete Random Variable X	$\mu = E(X)$ $= \sum xP(x)$	$Var(X) = E(X^2) - [E(X)]^2$ **where** $E(X^2) = \sum x^2 P(x)$
Continuous Random Variable X	$\mu = E(X)$ $= \int_{-\infty}^{\infty} xf(x)dx$	$Var(X) = E(X^2) - [E(X)]^2$ **where** $E(X^2) = \int_{-\infty}^{\infty} x^2 f(x)dx$

2.

	Formula	**Mean**	**Standard Deviation**
Binomial Probability	$P(x) = \binom{n}{x} p^x q^{n-x}$	$\mu = np$	$\sigma = \sqrt{npq}$
Poisson Probability	$P(x) = \frac{e^{-\lambda}\lambda^x}{x!}$	$\mu = \lambda$	$\sigma = \sqrt{\lambda}$

3. The z value for a value of x: $z = \frac{x - \mu}{\sigma}$

4. The z value for a value of $\bar{x}$: $z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

where $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

5. Sampling error = $\bar{x} - \mu$

Non-sampling error = incorrect $\bar{x}$ − correct $\bar{x}$

6. Point estimate of μ = $\bar{x}$

Margin of error = $\pm 1.96\sigma_{\bar{x}} = \pm 1.96\frac{\sigma}{\sqrt{n}}$ or $= \pm 1.96 s_{\bar{x}} = \pm 1.96\frac{s}{\sqrt{n}}$

7. The $(1-\alpha)100\%$ confidence interval for μ is

$\bar{x} \pm z\sigma_{\bar{x}}$ if σ is known

$\bar{x} \pm z s_{\bar{x}}$ if σ is not known

where $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ & $s_{\bar{x}} = \frac{s}{\sqrt{n}}$

End of Paper